

What is claimed is:

1 Claim 1. A process for transmitting a transmission payload data bit-
2 stream through a free-space medium, said process comprising the steps
3 of:

4 encoding a transmission payload data bit-stream into codewords;
5 fragmenting each said codeword into segments;
6 in a SDRAM buffer store having an entry receive and transmit
7 rate and comprising a matrix of memory cells, defining an x-y
8 submatrix of said cells representing the set of entries comprising a single
9 SDRAM physical page;

10 in a WRITE operation having a first page-change overhead
11 operation, interleaving corresponding segments of successive said
12 codewords into said submatrix of cells;

13 in a READ operation having a second page-change overhead
14 operation, reading out the contents of said submatrix of cells; and

15 transmitting the encoded and interleaved data-bit stream of said
16 READ operation into said medium;

17 said WRITE and READ operations into and out of said submatrix
18 of cells being conducted to substantially redistribute page change
19 overhead operations from said WRITE operation to said READ operation,
20 thereby to equalize the rate of said WRITE and READ operations.

1 Claim 2. The process of claim 1, wherein the step of encoding of said
2 transmission payload data bit-stream into codewords is effected using
3 Reed-Solomon coding.

1 Claim 3. The process of claim 2, further comprising the step of
2 dimensioning said submatrix of cells such that the minimum matrix
3 dimension representing the number of successive memory references that
4 occur before a page change during a said READ operation is sufficient
5 to amortize SDRAM overhead for a said page change.

1 Claim 4. The process of claim 3, wherein said redistribution of page
2 change overhead operations from said WRITE operation to said READ
3 operation comprises the further steps of:

4 WRITING into successive columns of said submatrix cells
5 corresponding segments of successive said codewords comprising a said
6 SDRAM page;

7 remapping t submatrix cell addresses for READout to maintain the
8 number of columns held on one page to a number that ensures a
9 physical SDRAM page change at intervals which makes the READ and
10 WRITE rates substantially equal.

1 Claim 5. The process of claim 4, wherein said free-space medium is
2 optical and wherein said transmission payload data bit-stream is optical
3 frequency.

1 Claim 6. The process of claim 5, comprising the further steps of
2 sensing conditions in said medium which cause scintillation
3 effects; and
4 activating said encoding and interleaving steps when said
5 conditions are detected.

1 Claim 7. The process of claim 6, further comprising the step of
2 deinterleaving and decoding said encoded and interleaved data-bit
3 stream at a remote receiver.

1 Claim 8. The process of claim 7, wherein
2 said SDRAM buffer store is large enough to correct an error burst
3 of the order of 20 million bits,
4 said Reed-Solomon code is of (255,223), format;
5 said encoding step comprises encoding said incoming data
6 stream into substantially 156,250 codewords to be interleaved;
7 said codeword size is 2040 bits; and
8 said segmenting step comprises segmenting each said
9 codeword into 60-bit segments for interleaving.

1 Claim 9. A process for optical free-space communications wherein the
2 communications medium is subject to intervals of burst error due to
3 atmospheric scintillation, said process comprising the steps of:

4 using Reed-Solomon coding, encoding a transmission payload data
5 bit-stream into codewords;

6 fragmenting each of a selected series of said codewords into
7 segments;

8 interleaving corresponding said segments of said codewords over a
9 substantial span of said payload data-bit stream that is large compared to
10 an anticipated burst error interval;

11 WRITING said interleaved segments into designated addresses of
12 a permutation buffer comprising banks of SDRAM devices arrayed as a
13 matrix of megaword stores with physical row-and-column addresses

14 wherein each said row constitutes a page, each said SDRAM device
15 having a burst memory cycle rate;

16 establishing virtual addresses by designating each physical row in
17 SDRAM memory as multiple virtual pages;

18 mapping said virtual addresses onto said physical addresses of
19 each said SDRAM device;

20 READING from said banks of SDRAM devices the content of
21 said actual addresses in a sequence determined by the re-mapped virtual
22 pages, said sequence being chosen in such a way that the processing
23 overhead associated with row-address changes is roughly equal in both
24 said WRITE step and said READING OUT step, thereby to enable each
25 said SDRAM device to operate asymptotically close to its burst memory
26 cycle rate; and

27 transmitting into said communications medium the encoded and
28 interleaved data-bit stream of said READING step.

1 Claim 10. The process of claim 9, wherein said WRITING step further
2 comprises writing K consecutive entries into one physical page, and
3 said READING step comprises changing pages every K entries.

1 Claim 11. The process of claim 10, comprising the further steps of
2 sensing conditions in said communications medium which cause
3 scintillation effects; and
4 activating said encoding and interleaving steps when said
5 conditions are detected.

1 Claim 12. The process of claim 11, further comprising the step of
2 deinterleaving and decoding said encoded and interleaved data-bit stream
3 at a remote receiver to recover said transmission payload data bit-stream.

1 Claim 13. A process for transmitting and receiving optical free-space
2 communications wherein the communications medium is subject to
3 intervals of burst error due to atmospheric scintillation, said process
4 comprising the steps of:

5 at the transmitter end; encoding a transmission payload data bit-
6 stream into codewords;

7 fragmenting each said codeword into segments;

8 interleaving said codeword segments;

9 transmitting the interleaved said segments as a data-bit stream
10 into said optical free-space medium;

11 at the receiver end, receiving said transmitted data-bit stream; and
12 deinterleaving and decoding said transmitted data-bit stream;

13 wherein said interleaving step at said transmitter end and said
14 deinterleaving step at said receiver end comprises the further steps of

15 providing a SDRAM buffer store comprising a matrix of memory
16 cells, and having an entry receive and transmit rate;

17 defining an x-y submatrix of said cells representing the set of
18 entries comprising a single SDRAM physical page;

19 in a WRITE operation having a first page-change overhead
20 operation, interleaving corresponding segments of successive said
21 codewords into said submatrix of cells;

22 in a READ operation having a second page-change overhead
23 operation, reading out the contents of said submatrix of cells;

24 said WRITE and READ operations into and out of said submatrix
25 being conducted to substantially redistribute page change overhead
26 operations from said WRITE operation to said READ operation,
27 thereby to equalize the rate of said WRITE and READ operations.

1 Claim 14. Apparatus for transmitting a transmission payload data bit-
2 stream through an optical free-space medium, said apparatus comprising:
3 means for encoding an optical transmission payload data bit-
4 stream into codewords using Reed-Solomon encoding
5 means for fragmenting each said codeword into segments;
6 a SDRAM buffer store having an entry receive and transmit rate
7 and comprising a matrix of memory cells,
8 said SDRAM buffer store further having a defined repeating x-y
9 submatrix of said cells representing the set of entries comprising a single
10 SDRAM physical page;
11 means for effecting a WRITE operation to interleave
12 corresponding segments of successive said codewords into said repeating
13 submatrix of cells;
14 said WRITE operation having an associated first page-change
15 overhead operation,
16 means for effecting in a READ operation to read out the contents
17 of said submatrix of cells;
18 said READ operation having an associated second page-change
19 overhead operation,
20 said WRITE and READ operations into and out of said submatrix
21 of cells being conducted to substantially redistribute page change

22 overhead operations from said WRITE operation to said READ operation,
23 thereby to equalize the rate of said WRITE and READ operations; and
24 means for transmitting the encoded and interleaved data-bit stream
25 of said READ operation into said medium.
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1 Claim 15. Apparatus in accordance with claim 14, further comprising
2 means for dimensioning said submatrix of cells such that the minimum
3 matrix dimension representing the number of successive memory
4 references that occur before a page change during a said READ
5 operation is sufficient to amortize SDRAM overhead for a said page
6 change.

1 Claim 16. Apparatus in accordance with claim 15, wherein said
2 redistribution of page change overhead operations from said WRITE
3 operation to said READ operation further comprises:
4 apparatus for WRITING into successive columns of said
5 submatrix cells corresponding segments of successive said codewords
6 comprising a said SDRAM page; and
7 apparatus for remapping submatrix cell addresses for READout to
8 maintain the number of columns held on one page to a number that
9 ensures a physical SDRAM page change at intervals which makes the
10 READ and WRITE rates substantially equal.

1 Claim 17. Apparatus in accordance with claim 16, further comprising:

2 means for sensing conditions in said medium which cause
 3 scintillation effects; and
 4 means for activating said encoding and interleaving steps when
 5 said conditions are detected.

1 Claim 18. Apparatus in accordance with claim 17, further comprising
 2 means for deinterleaving and decoding said encoded and interleaved
 3 data-bit stream at a remote receiver.

Claim 19. Apparatus in accordance with claim 18, wherein:

said SDRAM buffer store comprises a storage cell capacity
 sufficiently large to correct an error burst of the order of 20 million
 bits;

said Reed-Solomon code is of the (255,223) format;

said encoding means encodes said incoming data stream into
 substantially 156,250 codewords to be interleaved;

said codeword size is 2040 bits; and

said segmenting means segments each said codeword into 60-bit
 segments for interleaving in said submatrices of said SDRAM buffer store.